ROTATION KEY DEVICE FOR A PORTABLE TERMINAL

This application is a continuation-in-part of prior Application No. 10/356,552, filed February 3, 2003.

PRIORITY

This application claims priority under 35 U.S.C. § 119 to an application entitled "Rotation Key Device For a Portable Terminal" filed in the Korean Intellectual Property Office on December 3, 2002 and assigned Serial No. 2002-76194 and to an application entitled "Rotation Key Device For a Portable Terminal" filed in the Korean Intellectual Property Office on July 1, 2003 and assigned Serial No. 2003-44409, the contents of both of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a rotation key device for a portable terminal, and more particularly, to a rotation key device for a portable terminal which includes a rotation key configured to rotate in forward and reverse directions, thereby being capable of rapidly achieving selection and confirmation of a desired operating mode function.

Description of the Related Art:

Generally, bar-type wireless terminals are configured to have a bar-shaped single housing. Flip-type wireless terminals are configured such that a flip or cover is rotatably mounted to a bar-shaped housing by means of a hinge device, and folder-type wireless terminals are configured such that a folder is rotatably mounted to a bar-shaped housing by means of a hinge device so that it is foldable. Such conventional portable terminals are often equipped with an antenna unit, a data input/output unit, and a data transmitting/receiving unit. As is well known, a key pad is commonly used as the data input/output unit which is configured to input data when the keys provided thereon are

pressed by a user's finger. A touch pad or touch screen is also often used. In order to perform the function of displaying data generated in accordance with an operation of the data input/output unit, a liquid crystal display (LCD) is commonly used. The keypad used to input data has an arrangement of a plurality of keys which includes a conversation start button (i.e., a send (SND) key), a cancel key, a correction or clear (CLR) key, numeral keys, character keys, an end (END) key, function keys, a power (PWR) key, among others. Typically, 15 or 20 of such keys are arranged at desired positions on the upper surface of the housing of a portable terminal, respectively, so that they are outwardly exposed. As the user presses a selected one of the exposed keys, desired data is input.

The construction of a conventional portable terminal equipped with such keys will be described with reference to FIGs. 1 and 2. As shown in FIGs. 1 and 2, the conventional portable terminal, which is of a folder type, includes two parts: a body 1 and a folder 2. The body 1 carries a key button 1a, four-direction adjusting keys 1b and a microphone 1c, whereas the folder 2 carries an LCD 2a, and a speaker 2b. A hinge unit 3 is rotatably mounted between the body 1 and the folder 2. An antenna 4 is provided at the upper end of the body 10. The portable terminal also includes a switch unit which comprises a plurality of dome switches 6 in order to create pleasant tactile feeling when touched. As shown in FIG. 2, the dome switches 6 are provided at a printed circuit board (PCB) 5 mounted in the body 1. When a selected one of the dome switches 6 comes into contact with a corresponding contact 5a on the PCB 5 in accordance with a key pressing manipulation by the user, an associated signal is generated. The dome switch 6 is configured to sense the contact signal generated in response to the pressing manipulation by the user.

Of the respective dome switches 6 having such a configuration, there is a key button 1a and the 4-direction adjusting keys 1d, adapted to perform various functions.

Using the conventional key button 1a and 4-direction adjusting keys 1d equipped in the body of the conventional portable terminal, the user selects a desired sequence of keys in association with a desired operating mode function. However, this

procedure is inconvenient to the user, because the key sequence required to select and then confirm the operating mode function is complex. It is therefore impossible to achieve a rapid function switching operation. Furthermore, it is impossible to achieve a rapid mobile Internet search using the functions of the key button 1a and 4-direction adjusting keys 1d.

SUMMARY OF THE INVENTION

An object of the present invention is to substantially solve at least the above problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an object of the present invention is to provide a rotation key device for a portable terminal which includes a rotation key configured to rotate in forward and reverse directions, thereby being capable of rapidly selecting a desired sequence of keys in association with a desired operating mode function.

Another object of the invention is to provide a rotation key device for a portable terminal which includes a rotation key configured to rotate in forward and reverse directions, thereby being capable of rapidly achieving selection and confirmation of a desired operating mode function.

In accordance with an embodiment of the present invention, these objects are accomplished by providing in an apparatus for inputting data by use of keys in a portable terminal, a rotation key device comprising a base plate attached, at a lower surface thereof, to an upper surface of a first PCB mounted in a body of the portable terminal. A second PCB is attached, at a lower surface thereof, to the upper surface of the base plate, and the second PCB is provided with a plurality of first dome switches and a second dome switch at the lower and upper surfaces thereof, and with a plurality of contact surfaces along the circumference of the second dome switch, for receiving an electrical contact signal in either a fixed or rotated state of a contact terminal and thus sensing the rotated position of the contact terminal according to the rotation direction thereof. A ring-shaped washer is attached to the upper surface of the second PCB. A rotation key is supported by an upper surface of the ring-shaped washer so that the

rotation key is rotatable in forward and reverse directions by an external force applied thereto. A contact plate is provided in the rotation key to rotate along with the rotation key. A plurality of contact terminals is also provided wherein each is adapted to come into contact with one of the contact surfaces of the second PCB and to generate an electrical signal from a rotation contact and a fixed contact of the rotation key, and apply the electrical contact signal to each of the contact surfaces coming into contact therewith. A fixed button is coupled centrally with the rotation key so that the rotation key is rotatable.

In accordance with another embodiment of the present invention, these objects are accomplished by providing in an apparatus for inputting data by use of keys in a portable terminal, a rotation key device comprising a base plate attached, at a lower surface thereof, to an upper surface of a first PCB mounted in a body of the portable terminal, the base plate being substantially centrally provided at an upper surface thereof with a plurality of coupling protrusions. A second PCB is attached, at a lower surface thereof, to the upper surface of the base plate while allowing the coupling protrusions to extend therethrough. The rotation key device is further provided at the lower surface thereof with a plurality of dome switches, and at an upper surface thereof with a plurality of contact surfaces for receiving an electrical contact signal at either a rotated position or a fixed position of a contact terminal and sensing the rotated position of the contact terminal according to the rotation direction of the contact terminal. A ring-shaped washer is attached to the upper surface of the second PCB. A rotation key is supported by an upper surface of the ring-shaped washer so that the rotation key is rotatable in forward and reverse directions by an external force applied thereto. A contact plate is coupled to an upper surface of the rotation key to rotate along with the rotation key. A plurality of contact terminals is further provided and wherein each is adapted to come into contact with one of the contact surfaces of the second PCB and to generate an electrical contact signal at a rotation contact or a fixed contact of the rotation key. A fixed button is coupled with a center portion of the upper surface of the second PCB.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view illustrating a conventional folder type terminal in a state in which its folder is opened;

FIG. 2 is a cross-sectional view taken along the line A – A' of FIG. 1;

FIG. 3 is an exploded perspective view illustrating a rotation key device for a portable terminal in accordance with an embodiment of the present invention;

FIG. 4 is a perspective view illustrating an assembled state of the rotation key device according to the embodiment of the present invention;

FIG. 5 is a cross-sectional view taken along the line B – B of FIG. 4;

FIG. 6 is an enlarged sectional view of a portion "A" illustrated in FIG. 4;

FIG. 7 is a bottom view illustrating a base plate included in the rotation key in accordance with the embodiment of the present invention;

FIG. 8 is a cross-sectional view taken along the line C – C' of FIG. 7;

FIG. 9 is a plan view illustrating a second PCB included in the rotation key device in accordance with the embodiment of the present invention;

FIG. 10 is a bottom view illustrating the second PCB included in the rotation key device in accordance with the embodiment of the present invention;

FIG. 11 is an enlarged sectional view corresponding to a portion "B" of FIG. 9, illustrating the state in which a first contact terminal enters between first contact surfaces;

FIG. 12 is an enlarged sectional view corresponding to the portion "B" of FIG. 9, illustrating the state in which the first contact terminal enters between inserted contact surfaces;

FIG. 13 is an enlarged sectional view corresponding to a portion "C" of FIG. 9, illustrating the state in which a second contact terminal contacts a second contact surface;

FIG. 14 is a plan view illustrating a contact plate included in the rotation key device in accordance with the embodiment of the present invention;

FIG. 15 is a side sectional view illustrating the contact plate included in the

rotation key device in accordance with the embodiment of the present invention;

FIG. 16 is an enlarged sectional view of a portion "D" of FIG. 15;

FIG. 17 is an perspective view illustrating the portable terminal, to which the rotation key device according to the embodiment of the present invention is applied, in a state in which its folder is opened;

FIG. 18 is an exploded perspective view illustrating a rotation key device for a portable terminal in accordance with another embodiment of the present invention;

FIG. 19 is a plan view illustrating an assembled state of the rotation key device according to the second embodiment of the present invention;

FIG. 20 is a cross-sectional view taken along the line D – D' of FIG. 19;

FIG. 21 is an enlarged sectional view of a portion "E" illustrated in FIG. 20;

FIG. 22 is a plan view illustrating a base plate included in the rotation key in accordance with the second embodiment of the present invention;

FIG. 23 is a cross-sectional view taken along the line E – E' of FIG. 22;

FIG. 24 is an enlarged sectional view of a portion "F" illustrated in FIG. 23;

FIG. 25 is an enlarged sectional view of a portion "G" illustrated in FIG. 23;

FIG. 26 is a plan view illustrating a second PCB included in the rotation key device in accordance with the second embodiment of the present invention;

FIG. 27 is a bottom view illustrating the second PCB included in the rotation key device in accordance with the second embodiment of the present invention;

FIG. 28 is an enlarged sectional view corresponding to a portion "H" of FIG. 26, illustrating the state in which a first contact terminal enters between first contact surfaces;

FIG. 29 is an enlarged sectional view corresponding to the portion "H" of FIG. 26, illustrating the state in which the first contact terminal enters between inserted contact surfaces;

FIG. 30 is an enlarged sectional view corresponding to a portion "I" of FIG. 26, illustrating the state in which a second contact terminal contacts a second contact surface;

FIG. 31 is a plan view illustrating a rotation key in accordance with the second embodiment of the present invention;

FIG. 32 is a sectional view corresponding to the line F – F' of FIG. 31;

FIG. 33 is a plan view illustrating a contact plate included in the rotation key device in accordance with the second embodiment of the present invention;

FIG. 34 is a side sectional view illustrating the contact plate included in the rotation key device in accordance with the second embodiment of the present invention;

FIG. 35 is an enlarged sectional view of a portion "J" of FIG. 34; and

FIG. 36 is an perspective view illustrating the portable terminal, to which the rotation key device according to the second embodiment of the present invention is applied, in a state in which its folder is opened.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Several preferred embodiments of the present invention will now be described in detail with reference to the annexed drawings. In the drawings, the same or similar elements are denoted by the same reference numerals even though they are depicted in different drawings. In the following description, a detailed description of known functions and configurations incorporated herein have been omitted for conciseness.

Referring to the annexed drawings, in particular, FIG. 3, a rotation key device according to a preferred embodiment of the present invention is illustrated. This rotation key device is applied to a portable terminal which includes a terminal body 1. The rotation key device includes a body 10. The body 10 includes a base plate 30, a second PCB 40, a rotation key 70, a contact plate 80, and a fixed button 90, which are coupled to one another. A first bonding member 34 is attached to one surface of the base plate 30 so that the base plate 30 is bonded to an upper surface of the first PCB 20. A plurality of first dome switches 51 (four dome switches in the illustrated case) are provided at one surface of the second PCB 40, and one second dome switch 52 at a center portion of the other surface of the second PCB 40. A first switch bonding member 54 is provided at one surface of the second PCB 40 to bond the first dome switches 51 to the second PCB 40, whereas a second switch bonding member 55 is provided at the surface of the second PCB 40 to bond the second dome switch 52 to the second PCB 40. Coupling hole pairs 54a and 55a are formed in the center portions of the first and second switch bonding members 54 and 55 to allow a pair of coupling protrusions 91a formed at the

fixed button 90 to extend therethrough.

The second PCB 40 is formed with a plurality of contact surfaces 41 at the other surface, each adapted to receive an electrical signal in either a fixed state or rotated state of the contact plate 80 and thus to sense the rotated position of the contact plate 80 according to its rotation direction.

A ring-shaped washer 60 is attached to the upper surface of the second PCB 40 by means of a second bonding member 46, in order to allow the rotation key 70 to be rotatable. The rotation key 70 is laid on the upper surface of the ring-shaped washer 60 so that it is rotatable in forward and reverse directions by an external force applied thereto. The contact plate 80 is formed with a plurality of contact terminals 81 to contact the contact surfaces 41 of the second PCB 40 as the contact plate 80 rotates along with the rotation key 700. The contact plate 80 is laid on the upper surface of the rotation key 70 to generate electrical signals from rotational contacts and fixed contacts of the rotation key 70.

The fixed button 90 is provided rotatably at the center of the rotation key 70 such that the fixed button 90 extends through the second PCB 40, the ring-shaped washer 60 and the contact plate 80 in this order when it is coupled to the rotation key 70. Under the fixed button 90 is provided a fixing member 91 adapted to extend through a pair of coupling holes 31 formed at the base plate 30, the coupling hole pairs 54a and 55a, and a pair of coupling holes 42 of the second PCB 40. The base plate 30 has a circular disc structure while being centrally provided with the coupling holes 31 to receive fixing protrusions 91a of the fixing member 91. A through hole 32 is formed at the base plate 30 in the vicinity of the coupling holes 31, in order to receive an flexible printed circuit board (FPCB) 44 therethrough. An insertion hole 33 is formed in the base plate 30 to allow the second PCB 40 to extend therethrough.

The dome switches 51 and 52 are provided with a plurality of support members 53 to facilitate the operation of the dome switches 51 and 52 in contact with the support members 53. The pair of coupling holes 42 are formed centrally in the

second PCB 40, adapted to allow the fixing protrusions 91a of the fixing member 91 to extend therethrough. A plurality of light emitting diodes (LEDs) 43 are arranged along the circumference of the second PCB 40. The LEDs 43 emit light in response to electrical contact signals from the contact terminals 81. The FPCB 44 is disposed at a predetermined position of the second PCB 40, for delivering the contact signal of the second PCB 40 to the body 1. The second PCB 40 is provided, at a desired position on its circumference, with a contact portion 43 adapted to come into contact with the FPCB 44 so that electrical contact signals applied to the second PCB 40 can be sent to the interior of the body 100 via the FPCB 44. The contact surfaces 41 of the second PCB 40 includes a plurality of first contact surfaces 41a circumferentially arranged while being substantially uniformly spaced apart from one another on the upper surface of the second PCB 40. When each first contact surface 41a comes into contact with any one of first contact terminals 81a of the contact plate 80, it receives an electrical contact signal from the contact terminal. The contact surfaces 41 of the second PCB 40 further comprise a plurality of second contact surfaces 41b inside the first contact surfaces 41a. Also, the contact surfaces 41 of the second PCB 40 further comprise a plurality of inserted contact surfaces 41c, each formed at the upper surface of the second PCB 40 between adjacent ones of the first contact surfaces 41a. When the first contact terminal 81a enters any of the second contact surfaces 41b during rotating, the second contact surface 41b receives an electrical contact signal from the first contact terminal 81a. Each of the contact surfaces 41a and 41c are elongated or shortened to control the sensing speed of the first contact terminal 81a along with the rotation of the rotation key 70.

The contact terminals 80 comprises a pair of first contact terminals 81a adapted to generate an electrical contact signal in contact with any of the first contact surfaces 41a and the inserted contact surfaces 41c, and a pair of second contact terminals 81b in the vicinity of the first contact terminals 81a, adapted to support the rotation of the first contact terminals 81a, in contact with the second contact surfaces 41b.

A through hole 82 is centrally formed at the contact plate 80 so as to allow the fixing protrusions 91 of the fixed button 90 to extend therethrough. The contact terminals 81a and 81b of the contact plate 80 are arranged to be substantially uniformly spaced apart from one another in a circumferential direction, facing each other. Each contact terminal is formed by cutting out a desired portion of the contact plate 80 to leave a portion corresponding to the contact terminal, and then bending the left portion to be protruded toward the rotation key 70. The contact terminals 81a and 81b are substantially symmetrically arranged such that they face each other and the facing ones of the contact terminals cross each other in the rotating direction of the rotation key. Each contact terminal 81a or 81b has, at its free end, a bent portion 81c adapted to allow the contact terminal 80 to rotate in reliable contact with one of the contact surfaces 41. The contact plate 80 is made of a stainless steel material so that it is electrically conductive.

The rotation key 70 comprises an upper case 71 and a lower case 72. Fitting holes 73 are formed centrally at the upper and lower cases 71 and 72 to allow the fixed button 90 to fit thereinto. The upper case 71 of the rotation key 70 is provided with a first step 74 formed at the center in order to couple the rotation key 70 rotatably with the fixed button 90. A second step 75 is formed at the center of the lower case 72 couple the rotation key 70 rotatably with the fixed button 90. A case bonding member 76 is provided between the upper and lower cases 71 and 72 to bond them to each other. The fixing member 91 is provided with the fixing protrusions 91a to extend through the coupling holes 42 of the second PCB 40, the coupling holes 31 of the base plate 30 and the coupling holes 54a and 55a of the switch bonding members 54 and 55. A through hole 91b is formed at the center of the fixing member 91 to allow the support members 53 to extend therethrough from the rear direction and contact the second dome switch 52. The fixing protrusions 91a have, at their free ends, portions 91c to engage with the rear surface of the base plate 30.

A process for assembling and operating the rotation key device having the configuration according to the embodiment of the present invention as described above will now be described in detail with reference to FIGs. 3 to 17.

As shown in FIGs. 3 to 6, the first PCB 20 is first mounted in the body 10 of the portable terminal. Thereafter, the base plate 34 is attached, at its one surface, to the upper surface of the first PCB 20 by means of the first bonding member 40. The first four dome switches 51 are attached to one surface of the second PCB 20 by means of the first switch bonding member 54, while the second single dome switch 52 is attached to the center of the other surface of the second PCB 40 by means of the second switch bonding member 55.

The ring-shaped washer 60 is then attached to the upper surface of the second PCB 40 by means of the second bonding member 46 such that it is arranged around the circumference of the second PCB 40.

Under this condition, the contact plate 80 having the first and second contact terminal pairs 81a and 81b thereon is coupled to the upper surface of the rotation key 70. The fixed button 90 is coupled to the center of the rotation key 70 so that the rotation key 70 is rotatable. In this state, the fixed button 90 extends through the base plate 20, the second PCB 40, the ring-shaped washer 60, and the contact plate 80 in this order, coupling one another.

Since the fixing member 91 is under the fixed button 90 and has the fixing protrusions 91a, the fixing protrusions 91a extend through the coupling holes 31 of the base plate 20, the coupling holes 42 of the second PCB 40, and the coupling holes 54a and 55a of the switch bonding members 54 and 55.

As shown in FIGs. 5 to 8, extending through the coupling holes 31 of the base plate 30, the ends of fixing protrusions 91a are bent and fixedly coupled with the rear surface of the base plate 30.

As shown in FIG. 6, the rotation key 70 comprises the upper and lower cases 71 and 72, and the fitting holes 73 are formed at the centers of the upper and lower cases to fit the fixed button 90 thereinto.

The first step 74 formed at the center of the upper case 71 couples the fixed button 90 to the rotation key 70 such that the rotation key 70 is rotatable in forward and reverse directions by an external force applied thereto. The second step 75 formed at the center of the lower case 72 also couples the fixing member 91 of the fixed button 90 to the rotation key 70 such that the rotation key 70 is rotatable in forward and reverse directions by an external force applied thereto.

As shown in FIG. 9, the first and second contact terminal pairs 81a and 81b of the contact plate 80 are arranged to be substantially uniformly spaced apart from one another in a circumferential direction. Both the first and second contact terminal pairs 81a and 81b of the contact plate 80 are formed substantially symmetrically such the first contact pair 81a faces each other as does the second contact pair 81b. Both the first and second contact terminal pairs 81a and 81b cross each other in the rotating direction of the rotation key 70 and thus come into contact with the first and second contact surfaces 41a and 41b of the second PCB 40. Each contact terminal has, at its free end, a bent portion 81c adapted to allow the contact terminals to come into reliable contact with the contact surfaces 41a and 41b. Under this condition, when the rotation key 70 is rotated, the contact plate 80 also is rotated.

As shown in FIG. 9, the second PCB 40 is provided with the first and second contact surfaces 41a and 41b circumferentially arranged and substantially uniformly spaced apart from one another on the upper surface thereof. The first and second contact surfaces 41a and 41b can then receive electrical contact signals from the contact terminal 81a and 81b when contact plate 80 is in either a fixed or rotated state, thereby sensing a rotated position and direction of the rotation key 700.

As shown in FIG. 11, when any one of the first contact terminals 81a of the contact plate 80 enters between adjacent ones of the first contact surface 41a, an electrical contact signal is generated at the position of the first contact terminal 81a.

As shown in FIG. 12, the second contact surfaces 41b are defined inside the

first contact surfaces 41a. The inserted contact surfaces 41c are arranged along the circumference of the second contact surfaces 41b, so that the inserted contact surfaces 41c are between the first contact surfaces 41a. When any one of the first contact terminals 81a of the contact plate 80 enters between adjacent ones of the inserted contact surfaces 41c, an electrical contact signal is generated at the position of the first contact terminal 81a. The second contact terminals 81b support the first contact terminals 81a, while contacting the second contact surfaces 41b, so that the first contact terminals 81a can rotate.

A brief description will now be given of the sequence of electrical contact signals generated as each of the contact terminal 81a and 81b comes into contact with the first and second contact surfaces 41a, 41b and 41c in a sequential fashion in accordance with the rotation of the rotation key 70. It is assumed that the contact signals of the rotation key 70 correspond to "A", "B", "C", "D", and "E". When the rotation key 70 rotates in a forward, or clockwise (CW) direction, the contact signals from each of the contact terminals 81a and 81b are generated in a sequence of E-D-C-B-A-E·····. Alternatively, when the rotation key 700 rotates in a reverse, or counter-clockwise (CCW) direction, the contact signals from the contact terminals are generated in a sequence of A-B-C-D-E-A·····.

As shown in FIGs. 10 and 17, the sequence of contact signals from the contact terminals 81a and 18b are sent to the body 10 of the portable terminal via the FPCB 44 contacting the contact portion 45 of the second PCB 40. When a user selects a desired operation mode function while rotating the rotation key 70, and presses an associated button, an associated one of the dome switches 51 and 52 comes into contact with an associated contact of the second PCB 40. As a result, an electrical signal is applied to the second PCB 40, and then sent to the body 10 of the portable terminal via the FPCB 44.

The fixed button 90 performs one of operation mode functions given to the portable terminal, e.g., a cancel key function. When the user presses the fixed button 90, the dome switch 52 comes into contact with an associated contact of the second PCB

40. As a result, an electrical signal is applied to the second PCB 40, and then sent to the body 10 of the portable terminal via the FPCB 44.

The LEDs 43 are arranged along the circumference of the second PCB 40. The LEDs 43 emit light in response to electrical contact signals from the contact terminals 81, in order to illuminate the sides of the rotation key 70.

The first contact terminals 81a can be configured to quickly ascertain the rotation of the rotation key 70 by elongating the first contact surfaces 41a, and to minimize recognition of the rotation of the rotation key 70 by shortening the first contact surfaces 41a. Likewise, the first contact terminals 81a can be configured to quickly ascertain the rotation of the rotation key 70 by shortening the inserted contact surfaces 41c. The rotation recognizing speed of the first contact terminals 81a can be controlled by adjusting the lengths of the contact surfaces 41a and 41c.

By configuring the contact surfaces 41a and 41c as described above, the user can freely set the speed of scrolling on the LCD 2a. Given five first contact surfaces 41a for the first contact terminals 81a, one rotation of the rotation key 70 leads to 5-line scrolling on the LCD 2a at a time.

The process of assembling and operation of a rotation key device according to another embodiment of the present invention will now be described in detail with reference to FIGs. 18 to 36.

As shown in FIGs. 18 to 21, the rotation key device is applied to a portable terminal which includes a terminal body 100 provided with a first PCB 200. A first bonding member 300 is attached to one surface (lower surface) of the base plate 400 so that the base plate 400 is bonded to the upper surface of the first PCB 200. A plurality of coupling protrusions 401 (shown in FIG. 19) are centrally provided at the other surface (upper surface) of the base plate 400 in order to couple a second PCB 500 to the upper surface of the base plate 400 by means of a second bonding member 301. A plurality of first coupling holes 503 are centrally formed on the second PCB 500 to engage with the

coupling protrusions 401.

A plurality of dome switches 501 (five dome switches in the illustrated case) are provided at one surface (lower surface) of the second PCB 500. The second PCB 500 is formed with a plurality of contact surfaces 502 at the other surface (upper surface). With the coupling protrusions 401 of the base plate 400 extended through the first coupling holes 503, a ring-shaped washer 600 is attached to the upper surface of the second PCB 500 by means of a third bonding member 302. The ring-shaped washer 600 is peripherally provided over the second PCB 500.

As shown in FIGs. 20 and 21, the second PCB 500 and the ring-shaped washer 600 are coupled in this order to the base plate 400. A rotation key 700 is rotatably laid on the ring-shaped washer 600. As shown in FIG. 21, the rotation key 700 is provided with a circumferential step 703 extending along the circumference of the rotation key 700. The circumferential step 703 engages with arc-shaped grooves 403 circumferentially formed at the base plate 400. The rotation key 700 is rotatable on the ring-shaped washer 600 in forward and reverse directions by an external force applied thereto, as shown in FIGs. 31 and 32.

As shown in FIGs. 18 through 22, a second through hole 701 is centrally formed in the rotation key 700 so that the rotation key 700 is attached to base plate 400 with the coupling protrusions 401 of the base plate 400 extending through the second through hole 701. In this state, a contact plate 800 is mounted on the upper surface of the rotation key 700, as shown in FIG. 18

As shown in FIG. 18, the rotating key 700 is also provided with a plurality of third through holes 702. The third through holes 702 extend circumferentially while being substantially uniformly spaced apart from one another. The third through holes 702 are substantially symmetrically arranged such that they face each other. The third through hole 702 allow first and second contact terminals 801 of the contact plate 800 to extend therethrough and come into contact with first and second contact surfaces 502a and 502b of the second PCB 500 (See FIG. 26). Thus, as the contact plate 800 is

coupled to the rotation key 700, the first and second contact terminals 801 and 802 are brought into contact with the first and second contact surfaces 502a and 502b through the third through holes 702. The first and second contact terminals 801 and 802 of the contact plate 800 are arranged to be substantially uniformly spaced apart from one another in a circumferential direction. Both the first and second contact terminal pairs 801 and 802 of the contact plate 800 are formed substantially symmetrically such the first contact pair 801 faces each other as does the second contact pair 802. Both the first and second contact terminal pairs 801 and 802 cross each other in the rotating direction of the rotation key 700.

Each of the contact terminals 801 and 802 has, at its free end, a bent portion 801a or 801b adapted to allow the contact terminals 801 and 802 to come into reliable contact with the contact surfaces 502.

A fixed button 900 is bonded to a central portion of the upper surface of the second PCB 500 by means of a fourth bonding member 303. A plurality of coupling grooves 901 are formed at the circumference of the fixed button 900. The coupling grooves 901 are engaged with the coupling protrusions 401 of the base plate 400, while the coupling protrusions 401 extend first through the second PCB 500, then through the washer 600, and finally the contact plate 800. If the contact plate 800 is rotated under this condition, the rotation key 700 is also rotated.

The contact surfaces 502 of the second PCB 500 comprise a plurality of first and second contact surfaces 502a and 502b formed at the upper surface of the second PCB 500 (see FIG. 26) such that they are circumferentially arranged while being substantially uniformly spaced apart from one another. They receive an electrical contact signal in a fixed state of the contact plate 800 or during the rotation of the contact plate 800, to thereby sense the rotation positions of the first and second contact terminals 801 and 802 according to the rotation directions of the first and second contact terminals 801 and 802.

As shown in FIG. 28, when the first contact terminal 801 come between the

first contact surfaces 502a as the first contact terminal 801s rotate in a certain direction, electrical contact signals are generated at the inserted positions of the first contact terminals 801.

As shown in FIG. 29, the second contact surfaces 502b are defined inside the first contact surfaces 502a. A plurality of inserted contact surfaces 502c are provided along the circumference of the second contact surfaces 502b to allow the contact terminals 801 between the first contact surfaces 502a. When any of the first contact terminals 801 comes between adjacent ones of the inserted contact surfaces 502c between the first contact surfaces 502a along with the rotation of the first contact terminal 801 in a certain direction, an electrical contact signal is generated at the position of the first contact terminal 801. The second contact terminal pair 802 is in contact with the second contact surfaces 502b, while supporting the first contact terminals 801 rotatably.

A brief description will now be given of the sequence of electrical contact signals generated as the contact terminals 801 and 802 come into contact with the contact surfaces 502a, 502b and 502c in accordance with the rotation of the rotation key 700.

It is assumed that the contact signals of the rotation key 700 correspond to "A", "B", "C", "D", and "E". When the rotation key 700 rotates in a forward or clockwise (CW) direction, the contact signals from the contact terminals 801 and 802 are generated in a sequence of E-D-C-B-A-E·····. Alternatively, when the rotation key 700 rotates in a reverse or counter-clockwise (CCW) direction, the contact signals from the contact terminal 801 are generated in a sequence of A-B-C-D-E-A·····. The sequence of contact signals from the contact between the first contact terminals 801 and the contact surfaces 502 are sent to the body 10 of the portable terminal via a flexible PCB 1000 contacting a contact portion 504 of the second PCB 500. When a user selects a desired operation mode function while rotating the rotation key 700, and presses an associated button, an associated one of the dome switches 501 comes into contact with an associated contact of the second PCB 500. As a result, an electrical signal is applied to

the second PCB 500, and then sent to the body 10 of the portable terminal via the flexible PCB 1000. The fixed button 900 performs one of a plurality of operation mode functions given to the portable terminal, e.g., a cancel key function. When the user presses the fixed button 900, the central dome switch 501 comes into contact with an associated contact of the second PCB 500. As a result, an electrical signal is applied to the second PCB 500, and then sent to the body 10 of the portable terminal via the flexible PCB 1000.

The first contact terminals 801 can be configured to quickly ascertain the rotation of the rotation key 700 by elongating the first contact surfaces 502a, and to minimize ascertainment of the rotation of the rotation key 700 by shortening the first contact surfaces 502a. Likewise, the first contact terminals 801 can be configured to quickly ascertain the rotation of the rotation key 700 by shortening the inserted contact surfaces 502c. The rotation recognizing speed of the first contact terminals 801 can be controlled by adjusting the lengths of the contact surfaces 502a and 502c.

By configuring the contact terminals 801 and 802 as described above, the user can freely set the speed of scrolling on the LCD 2a. Given five first contact surfaces 502a for the first contact terminals 801, one rotation of the rotation key 700 leads to 5-line scrolling on the LCD 2a at a time.

As shown in FIG. 36, since a rotation key 700 configured to rotate in forward (CW) and reverse (CCW) directions is provided at the body 10 of the portable terminal in accordance with the second embodiment of the present invention, it is possible to rapidly select a desired sequence of keys in association with a desired operating mode function in the portable terminal. It is also possible to rapidly and conveniently achieve the confirmation of the selected operating mode function.

While the invention has been shown and described with reference to certain preferred embodiments thereof, they are merely exemplary applications. For example, the present invention is not limited to a folder-type terminal. It is applicable to any of portable terminals. Therefore, it will be understood by those skilled in the art that

various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.